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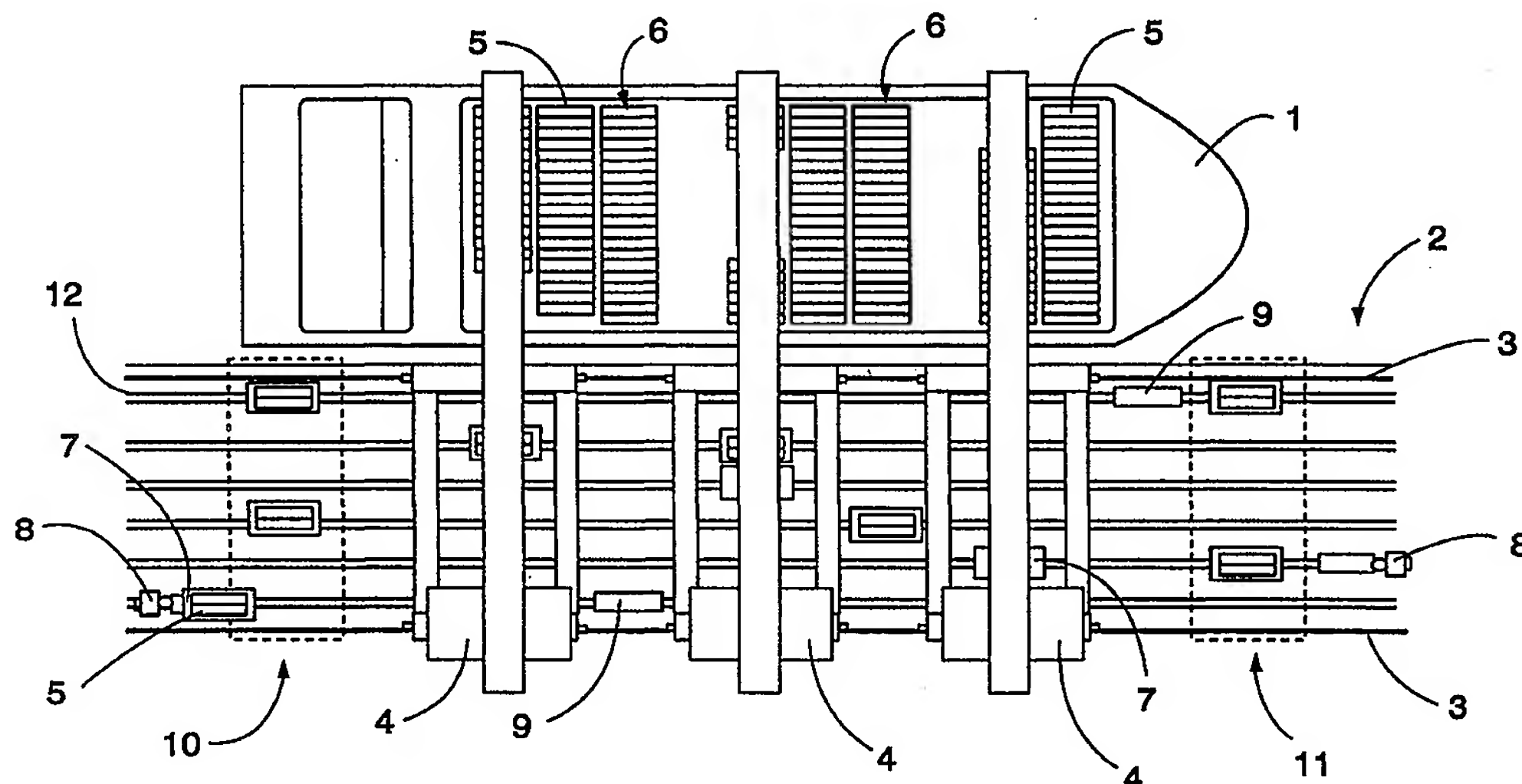
FI

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(54) Title: METHOD AND APPARATUS FOR LOADING A VESSEL WITH CONTAINERS AND FOR UNLOADING THE VESSEL

**(57) Abstract**

The invention relates to method of loading a vessel with containers and of unloading the vessel, according to which method at least one container crane (4) movable in the direction of the vessel (1) and movable transfer bodies (7) are used, on which containers (5) are lifted. A transfer trolley (9) moving between a supply point (10) and a removal point (11) is used for displacing the transfer bodies (7), the trolley positioning the transfer bodies (7) below the container cranes (4) according to the position of the container cranes (4). Further, the invention relates to an apparatus for loading a vessel with containers and for unloading the vessel. The apparatus comprises at least one container crane (4) movable in the direction of the vessel (1), at least one transfer body (7) and at least one transfer trolley (9), which is arranged to displace the transfer body (7) and to position it automatically according to the container crane (4).

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METHOD AND APPARATUS FOR LOADING A VESSEL WITH CONTAINERS AND FOR UNLOADING THE VESSEL

The invention relates to a method of loading a vessel with containers and of unloading the vessel, according to which method at least one container crane movable in the direction of the vessel moored at the quay and at least one movable transfer body, on which the container crane can lift the containers from the vessel and from which it can take the containers to be loaded on the vessel, respectively, and also means for displacing the transfer body are used for loading and unloading a vessel transporting containers.

The invention relates further to an apparatus for loading a vessel with containers and for unloading the vessel, the apparatus comprising at least one container crane movable in the direction of the vessel moored at the quay, at least one movable transfer body, on which the container crane is arranged to lift the containers to be unloaded from the vessel and from which it is arranged to take the containers to be loaded on the vessel, respectively, and also means for displacing the transfer body.

At sea transports, the use of containers is very popular, when unit loads are transported. Transport of bulk goods is quite another matter. Containers have the advantage that they are quick-handled and that a container protects its content well against weather conditions and impacts. Container ships specialized in transporting containers are usually divided roughly into two types of vessels, i.e. ro-ro (roll on - roll off) and lo-lo (lift on - lift off) ships. The first-mentioned ship type is loaded in such a way that a transfer body and containers loaded thereon are drawn into the ship by a special harbour vehicle, and as regards the latter type, the containers are lifted by a container crane usually on the deck of the ship. The biggest lo-lo ships used at present hold 12 containers side by side in the lateral direction of the ship, but the newest so-called fifth generation container ships under construction are capable of taking as much as 20 containers side by side, and thus they may hold up to 1000 containers. It is obvious that loading and unloading such a gigantic vessel is a massive operation. When present port facilities are used, the lay days of the ship are too many, in order that an efficient use of the ship could be possible. The ship company gets its income according to transport performances, i.e. from transporting freight from port A to port B. Orderers of a transport service do not pay for the time used for stowing, but only for the transport

itself. On the other hand, they may be prepared to pay more, if the total transport time is short. Investment calculations of ships are generally based on the assumption according to which the vessel is at sea 80 % of the total time, the remaining 20 % comprising stops at harbours and possible dock visits. By present arrangements, the harbours will not cope with this demand, as regards new ships, which are bigger than the previous ones.

At present, containers are unloaded from and loaded on a vessel by driving the ship to the quay and by mooring it at the edge of the basin. Subsequently, a container crane, or two cranes, if necessary, are driven to the ship on rails or similar means parallel with the edge of the basin and thus also with the ship moored at it, and an unloading and a simultaneous loading are started. Containers are lifted by the container crane from the ship on a particular transfer body intended for harbour use, drawn by a transport vehicle and positioned below the crane, after which the transport vehicle displaces the transfer bodies with the containers thereon to the storage area of the harbour. The containers are arranged and stacked in the storage area by means of reach trucks, mobile cranes and straddle carriers of different kinds. The arrival of the ship at the harbour and the subsequent unloading and loading cause a fervent traffic in the harbour area. Transport vehicles are driving continuously between the loading place and the storage area bringing containers to be loaded below the container crane and taking away containers unloaded from the ship to the storage area at the same time. At the foot of container cranes, in particular, there is much action and a great possibility of a collision. The present system enables a simultaneous use of maximally two container cranes per ship also in case of bigger ships, because the route for the transport vehicles below the crane and away from there shall be considered. Further, the transfer bodies are driven manually by means of transport vehicles below the crane, whereby human factors always make the positioning of the transport bodies below the crane somewhat inaccurate, which leads to that lifting containers by the crane on the transfer body and away from there does not always occur as desired. A need has arisen to develop container handling apparatuses and methods.

The object of the present invention is to provide a novel and efficient method and apparatus for loading and unloading a container ship.

The method according to the invention is characterized in that a supply point and a removal point are arranged at a distance from each other at

the quay, between which points travels at least one transfer trolley and to which points the transfer bodies are brought and from which they are taken for loading and unloading, and that the transfer bodies are displaced between the supply point, the container crane and the removal point by means of the
5 transfer trolley.

Further, the apparatus according to the invention is characterized in that a supply point and a removal point are arranged at a distance from each other at the quay, between which points at least one transfer trolley is arranged to travel and that displacing the transfer body between the supply
10 point, the container crane and the removal point is arranged to take place by means of the transfer trolley.

An essential idea of the invention is that transfer trolleys transporting transfer bodies to container cranes for loading and unloading are arranged to move automatically, controlled by a control system of the apparatus, from
15 the supply point of transfer bodies below the container cranes and further to the removal point. The traffic from the removal point to the storage area can be attended to in a conventional manner by means of transport vehicles, in the same way as from the storage area to the supply point. Another essential idea is that a transfer trolley positions a transfer body automatically at the right
20 place according to the container crane. The essential idea of a preferred embodiment of the invention is that rails or similar guide means are arranged at the edge of the quay, on which rails transfer trolleys are arranged to travel. The essential idea of another preferred embodiment of the invention is that, in its lower position, a transfer trolley without a load is capable of travelling below
25 a transfer body, which is positioned below the container crane and stands on its feet. Accordingly, the transfer trolley is capable of operating, even if transfer bodies are positioned in the direction of its path of movement.

An advantage of the invention is that, in the future, also so-called fifth generation gigantic container ships can now be handled efficiently in har-
30 bours, because the solution of the invention decisively increases the container handling capability of a harbour. This leads to that the lay days of both new and present ships will be less, which increases their transport performance and improves the cost-effectiveness. Further, the solution of the invention is flexible, for it is suitable for stowing both small and big vessels, which is due to
35 that the number of container cranes and transfer trolleys can be proportioned according to the size of the vessel. Moreover, the solution can be automated

rather far, and therefore, it can be applied with a limited manning, even entirely without a crew. Furthermore, all kinds of unnecessary action and traffic are reduced in the port area, when clear supply and removal points are used for the transfer bodies. The traffic can be made more logical, which decreases the risk of collision and improves the efficiency. One of the most remarkable advantages is that transfer bodies need not be positioned manually below a container crane any more, but they are positioned automatically according to the position of the container crane, through which it is possible to eliminate human errors and inaccuracies at the positioning and the loading and unloading take place flexibly, because the transfer body always is at the right position. In addition, it is possible to arrange more transfer bodies than previously side by side below the container crane, when the transfer bodies are displaced accurately by means of a transfer trolley and no big safety distances between the transfer bodies are needed any more.

The invention will be described in more detail in the attached drawings, where

Figure 1 shows schematically an arrangement of the invention for unloading and loading a container ship, and

Figure 2 shows schematically a transfer trolley of the invention seen in its direction of travel and partially in section.

Figure 1 shows the solution of the invention for unloading and loading a container ship schematically and from above. A vessel 1, which may be a container freight carrier similar to that shown in the figure and bigger than previously, is moored at a quay 2. Rails 3 or similar means are arranged for movable container cranes 4 at the edge of the quay 2, parallel with the edge. A number of container cranes 4, depending on the size of the vessel, can be driven on the rails 3 to a desired place at the vessel 1, and after that, lifting means of the container cranes 4 can start lifting containers 5 from the deck of the vessel 1, the lifting means being arranged to move in the transverse direction of the vessel. Modern harbour cranes are capable of handling two containers simultaneously by their lifting means. With the loading proceeding, the container crane 4 is displaced in the longitudinal direction of the vessel 1 according to container rows 6. The structure and operation of the container cranes are not described in more detail in this connection, because they are considered to belong to the know-how of one skilled in the art.

The solution of the invention differs from the previously known solutions therein that transfer bodies 7, on which the container cranes 4 lift containers 5, are not displaced by means of transport vehicles 8 below the container cranes 4 any more, but the transfer bodies 7 are displaced by means of transfer trolleys 9 between a supply point 10, the container cranes 4 and a removal point 11. Accordingly, more container cranes 4 than previously have place to operate simultaneously, because no space is required between the container cranes 4 for the routes of the transport vehicles 8. On the other hand, transfer bodies 7 are displaced from the storage area to the supply point 10 and from the removal point 11 to the storage area, respectively, preferably in a conventional manner by means of transport vehicles 8. A transfer trolley 9 is positioned automatically at the right place according to the position of the container crane 4. The positioning may take place for instance on the basis of a signal sent by the container crane 4, by means of photocells or in some other manner known per se. The advantage of this is that a time-consuming manual positioning of the transfer body 7 by means of the transport vehicle 8 is thus avoided. On the other hand, fixed guides can be arranged in the earth for positioning the transfer body 7 at the supply point 10, these guides facilitating the right positioning of the transfer body 7 at the supply point 10. It is possible to use fixed guides, for the position of the supply point 10 remains constant. Guides could not be used at the container cranes 4, because, firstly, the position of the cranes changes according to the vessels 1, and secondly, the cranes move parallel with the vessel 1 when loading proceeds. The structure of the transfer trolley 9 will be explained in more detail in the description of Figure 2.

A control system is arranged to control the system. In its simplest form, it controls only the operation of the transfer trolleys 9. The control system attends to that a transfer trolley 9 displaces transfer bodies 7 in the most efficient way between the supply point 10 and the removal point 11 so that a container crane 4 always has at its disposal a transfer body 7 from which to unload containers 5 and on which to unload containers 5 from the vessel 1. The control system can also be more versatile, whereby it controls the whole loading and unloading operation, i.e. also the container cranes 4. A control system of this kind enables an efficient co-ordination of unloading and loading. The control system may comprise a computer, which calculates how to unload and load a vessel 1 in a manner as efficient as possible. It also enables a drive

with a limited manning or even an entirely unmanned drive. Accordingly, the container cranes 4 and also the transfer trolleys 9 can be displaced at any place at the quay 2, whereby the same apparatuses can be used along the whole quay 2.

5 Figure 2 shows schematically a transfer trolley in its direction of travel and partially in section. The reference numerals of Figure 2 correspond to those of Figure 1. The transfer trolley 9 is preferably a device moving on rails or on other corresponding control means 12 by means of its own power source, the device being capable of driving below a transfer body 7, lifting up
10 the transfer body 7 in such a way that the legs 13 of the transfer body 7 are loose from the ground, and transporting the transfer body 7 to a desired place and laying it down to support on its own legs 13. Six parallel transfer trolleys 9 or even more can be arranged to move in the way seen in Figure 1. Four
15 containers 5 can be lifted on the transfer body 7 of Figure 2, two side by side and two on each other. Such a transfer body 7 is especially suitable for being used with modern container cranes handling two containers 5 at a time. Lifting up a transfer body 7 can be arranged to take place by means of hydraulic cylinders 14 or other suitable lifting means, for instance. There is room for a transfer trolley 9 to move below the transfer body 7, when the lifting means of
20 the trolley are lowered. When being empty, it can thus move in the loading area in spite of that there are transfer bodies 7 to be loaded or unloaded on its route. In this manner, the transfer trolleys 9 can move and displace transfer bodies 7 efficiently and flexibly. The transfer trolley 9 obtains its operating energy preferably from conductors arranged in connection with the control
25 means 12, but also other manners may be applied. Control information can also be transmitted by conductors or by radio waves, for instance.

The drawings and the specification relating to them are only intended to illustrate the idea of the invention. Concerning the details, the invention may vary within the scope of the claims. Accordingly, it is possible to
30 arrange the supply point and the removal point of transfer bodies directly in the storage area, whereby transport vehicles are not necessarily needed for the transfer bodies at all, but the transfer bodies and the containers stacked on them can be transported by means of transfer trolleys directly to the storage area and the containers can be unloaded from the transfer body by means of a
35 mobile crane, for instance, and stacked on a desired place at the same time. In this way, one intermediate stage is omitted and handling times decrease,

correspondingly. It is also possible to implement the displacement of transfer trolleys between the supply point, the container cranes and the removal place without the rails mentioned as an example. A control cable can be sunk into the earth, which cable the transfer trolley follows like a so-called automatic
5 guided vehicle, or the transfer trolley can be controlled entirely without control means by transmitting the control information by radio. In addition, it shall be stated that the concept "below the container" in this application means an area into which a crane is capable of moving its load and from which it is capable of taking load to be loaded on a vessel.

CLAIMS

1. A method of loading a vessel with containers and of unloading the vessel, according to which method at least one container crane (4) movable in the direction of the vessel (1) moored at the quay (2) and at least one
5 movable transfer body (7), on which the container crane (4) can lift the containers (5) from the vessel (1) and from which it can take the containers (5) to be loaded on the vessel (1), respectively, and also means for displacing the transfer body (7) are used for unloading and loading a vessel (1) transporting
10 containers (5), **characterized** in that a supply point (10) and a removal point (11) are arranged at a distance from each other at the quay (2), between which points travels at least one transfer trolley (9) and to which points the transfer bodies (7) are brought and from which they are taken for loading and unloading, and that the transfer bodies (7) are displaced between the supply point (10), the container crane (4) and the removal point (11) by
15 means of the transfer trolley (9).

2. A method according to claim 1, **characterized** in that the transfer body (7) is positioned at the right position below the container crane (4) according to a signal detecting the position of the container crane (4).

20 3. A method according to claim 1 or 2, **characterized** in that the transfer trolley (9) is arranged to travel between the supply point (10) and the removal point (11) on control means (12) in the direction of travel of the container crane (4).

25 4. A method according to any preceding claim, **characterized** in that the transfer bodies (7) are positioned in the direction of travel of the transfer trolley (9), that the transfer trolleys (9) may pass the transfer bodies (7) below them and that the transfer trolley (9) comprises lifting means, by which it may lift the transfer body (7) from below it loose from the ground and transport it to a desired place.

30 5. An apparatus for loading a vessel with containers and for unloading the vessel, the apparatus comprising at least one container crane (4) movable in the direction of the vessel (1) moored at the quay (2), at least one movable transfer body (7), on which the container crane (4) is arranged to lift the containers (5) to be unloaded from the vessel (1) and from which it is ar-
35 ranged to take the containers (5) to be loaded on the vessel (1), respectively, and also means for displacing the transfer body (7), **characterized** in

that a supply point (10) and a removal point (11) are arranged at a distance from each other at the quay (2), between which points at least one transfer trolley (9) is arranged to travel, and that displacing the transfer body (7) between the supply point (10), the container crane (4) and the removal point (11) is arranged to take place by means of the transfer trolley (9)

6. An apparatus according to claim 5, **characterized** in that the transfer trolley (9) is arranged to position the transfer body (7) at the right position below the container crane (4) according to a signal detecting the position of the container crane (4).

10 7. An apparatus according to claim 5, **characterized** in that the transfer trolley (9) is arranged to travel between the supply point (10) and the removal point (11) on control means (12), such as rails, in the direction of travel of the container crane (4).

15 8. An apparatus according to any of the claims 5 to 7, **characterized** in that the transfer trolley (9) comprises lifting means, in the lower position of which the transfer trolley (9) can move below the transfer body (7) and that the transfer trolley (9) is arranged to lift the transfer body (7) below it loose from the ground by its lifting means and to transport the transfer body (7) to a desired place, subsequently.

20 9. An apparatus according to any of the claims 5 to 8, **characterized** in that the apparatus comprises a control system arranged to control the operations of the transfer trolley (9).

10. An apparatus according to claim 9, **characterized** in that the control system is arranged to control the whole apparatus.

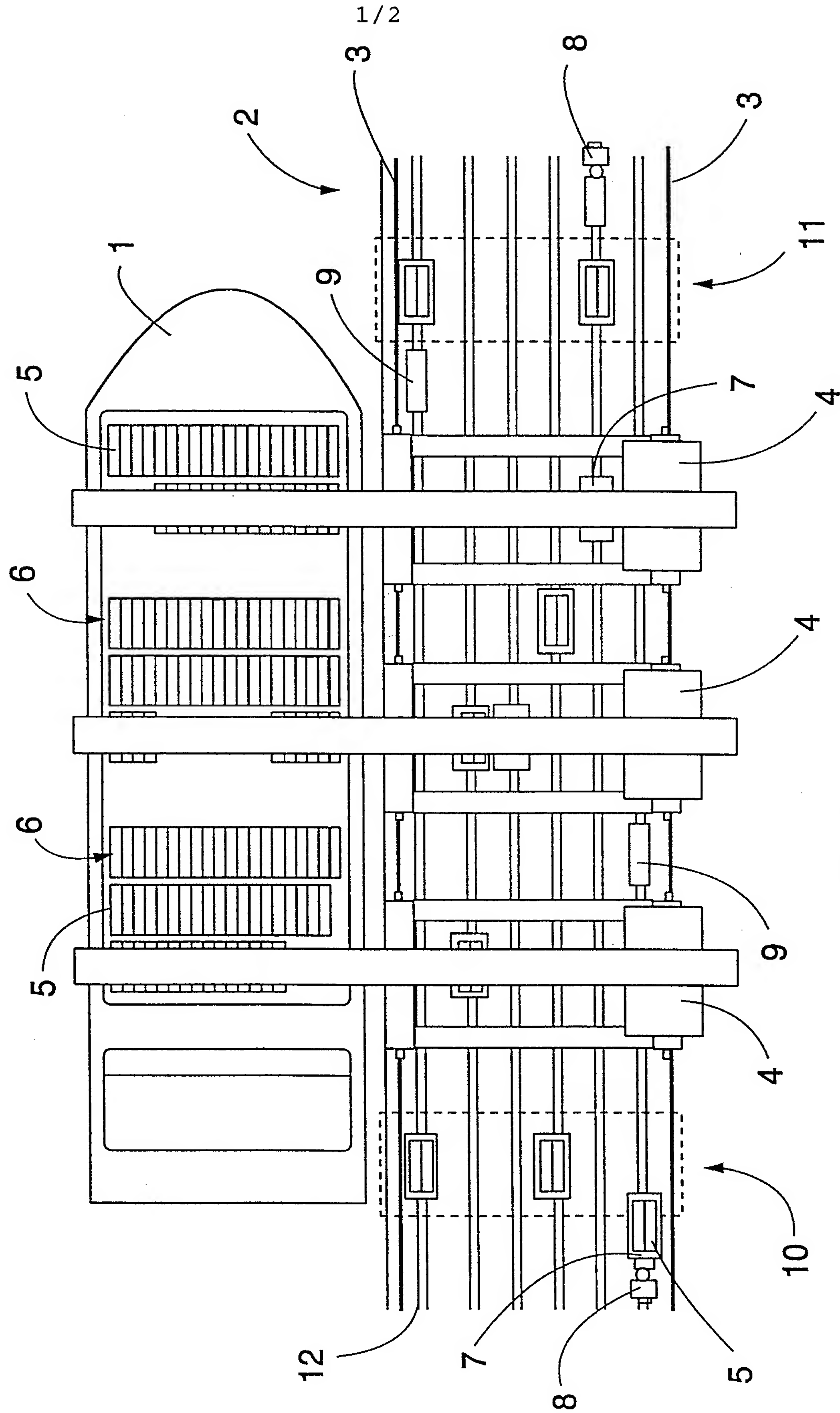
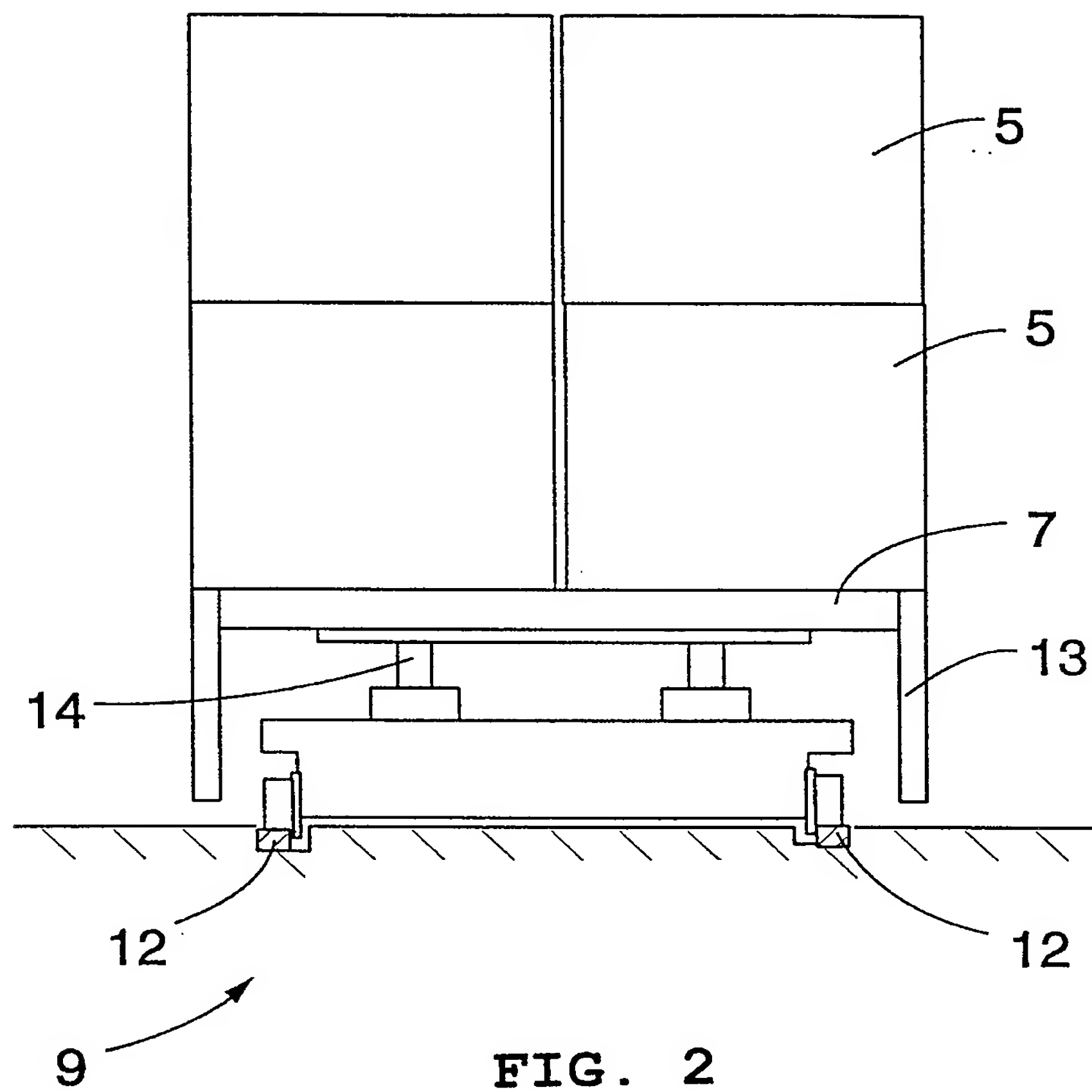


FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00542

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: B65G 63/00 // B65G 67/60 According to International Patent Classification (IPC) or to both national classification and IPC		
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IPC6: B65G		
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Date of the actual completion of the international search		Date of mailing of the international search report
7 Sept 1998		10 -09- 1998
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00542

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INTERNATIONAL SEARCH REPORT

Information on patent family members

27/07/98

International application No.

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INVENTOR-INFORMATION:

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NAME	COUNTRY
ROLUX TRANSPORT SYSTEMS LTD	FI
VAENNINMAJA PEKKA	FI

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ABSTRACT:

CHG DATE=19990905 STATUS=C>The invention

relates to method of loading a vessel with containers and of unloading the vessel, according to which method at least one container crane (4) movable in the direction of the vessel (1) and movable transfer bodies (7) are used, on which containers (5) are lifted. A transfer trolley (9) moving between a supply point (10) and a removal point (11) is used for displacing the transfer bodies (7), the trolley positioning the transfer bodies (7) below the container cranes (4) according to the position of the container cranes (4). Further, the invention relates to an apparatus for loading a vessel with containers and for unloading the vessel. The apparatus comprises at least one container crane (4) movable in the direction of the vessel (1), at least one transfer body (7) and at least one transfer trolley (9), which is arranged to displace the transfer body (7) and to position it automatically according to the container crane (4).